CLAIMS

What is claimed is:

1.   1. A method of locating an entry in a forwarding database corresponding to a longest

    2.   match of an address, the method comprising the steps of:

    3.   a)   applying a mask to the address to determine a masked address that is to be

    4.   used for purposes of locating a matching entry in the forwarding database;

    5.   b)   searching the forwarding database for an entry that matches the masked

    6.   address;

    7.   c)   performing an address-sensitive decimation of the mask to produce a new

    8.   mask; and

    9.   d)   until a predetermined condition has been met, repeating steps a-c with the

    10.   new mask.

2.   2. The method of claim 1, further comprising the step of performing a hash function

    2.   on the masked address to produce an index into a hash table.

3.   3. The method of claim 2, wherein the step of performing an address-sensitive

    2.   decimation of the mask to update the mask comprises shortening the mask such that

    3.   the application of the mask to the address will exclude enough data to cause the

    4.   hash function to produce a result that is different from the former index.

4.   4. The method of claim 3, wherein the step of shortening the mask such that the

    2.   application of the mask to the address will exclude enough data to cause the hash

    3.   function to produce a result that is different from the former index comprises

    4.   shortening the length of the mask to X-Y bits, where X represents the bit position

5   of the most significant bit in the address, and where Y represents the bit position of

6   the least significant bit containing a one.

1   5.   The method of claim 1, wherein the predetermined condition comprises a matching

2   entry has been located or the length of the mask is equal to a predetermined

3   threshold.

1   6.   The method of claim 1, wherein one or more new masks are generated in parallel

2   with the step of searching the forwarding database for a matching entry.

1   7.   The method of claim 1, wherein each entry in the forwarding database includes N-

2   bits of address and an associated mask length encoded in N+1 bits of address

3   information, and the step of searching the forwarding database for a matching entry

4   comprises the steps of:

5   determining the mask length associated with an entry based upon the location of a

6   mask length identification marker within the address information;

7   comparing the mask length associated with the entry with the mask that has been

8   applied to the address; and

9   if the mask length associated with the entry is less than or equal to the mask that has

10   been applied to the address, then comparing a significant portion of the

11   address information with the masked address, the significant portion of the

12   address information being identified by the mask length associated with the

13   entry.

1   8.   The method of claim 7, wherein the mask length identification marker comprises the

2   least significant bit in the address information containing a one, and wherein the

3   step of determining the mask length associated with an entry based upon the

4   location of a mask length identification marker within the address information

5   comprises scanning the address information to locate the bit position of the least

6   significant bit containing a one.

1   9. A method of locating an entry in a forwarding database corresponding to a longest

2   match of a search key, the method comprising the steps of:

3   a)   searching the forwarding database for an entry that matches the search key;

4   and

5   b)   if no entry matches the search key, then

6   1)   scanning the search key to locate the least significant bit containing a

7   one,

8   2)   shortening the search key to exclude the least significant bit

9   containing a one,

10   3)   searching the forwarding database for an entry that matches the

11   search key, and

12   4)   repeating steps 1-3 until the search key is equal to a predetermined

13   length or until the longest match is located.

1   10.   The method of claim 9, wherein the step of shortening the search key to exclude the

2   least significant bit containing a one comprises the steps of:

3   providing a mask of length X-Y, where X represents the bit position of the most

4   significant bit in the search key, and where Y represents the bit position of

5   the least significant bit containing a one; and

6   applying the mask to the search key.

1 11. The method of claim 9, wherein the search key comprises a destination Internet

2 Protocol (IP) address.

1 12. The method of claim 19, wherein the search key comprises a source Internet

2 Protocol (IP) address.

1 13. A method of forwarding data comprising the steps of:

2 receiving data at a port;

3 extracting an address from the data;

4 searching a forwarding database for a longest match for the address by

5 comparing a portion of the address indicated by a mask to entries in the

6 forwarding database, and

7 progressively shortening the mask based upon the address until a matching

8 entry is located; and

9 forwarding the data to a destination associated with the matching entry.

1 14. The method of claim 13, further comprising the step of performing a hash function

2 on the portion of the address to produce an index into a hash table.

1 15. The method of claim 14, wherein the step of progressively shortening the mask

2 based upon the address comprises, for each search iteration, shortening the mask

3 such that the application of the mask to the address will exclude enough data to

4 cause the hash function to produce a result that is different from the former index.

1 16. The method of claim 13, wherein the step of progressively shortening the mask

2 based upon the address until a matching entry is located comprises, for each search

3 iteration, shortening the length of the mask to X-Y bits, where X represents the bit

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4   position of the most significant bit in the address, and where Y represents the bit

5   position of the least significant bit containing a one.

1   17.   The method of claim 13, wherein each entry in the forwarding database includes N-

2   bits of address and an associated mask length encoded in N+1 bits of address

3   information, and the step of comparing a portion of the address indicated by a mask

4   to entries in the forwarding database comprises the steps of:

5   determining the mask length associated with an entry based upon the location of a

6   mask length identification marker within the address information;

7   comparing the mask length associated with the entry with the mask; and

8   if the mask length associated with the entry is less than or equal to the mask, then

9   comparing a significant portion of the address information with the portion

10   of the address indicated by the mask, the significant portion of the address

11   information being identified by the mask length associated with the entry.

1   18.   The method of claim 17, wherein the mask length identification marker comprises

2   the least significant bit in the address information containing a one, and wherein the

3   step of determining the mask length associated with an entry based upon the

4   location of a mask length identification marker within the address information

5   comprises scanning the address information to locate the bit position of the least

6   significant bit containing a one.

1   19.   The method of claim 13, wherein the address comprises a 32-bit or a 128-bit

2   Internet Protocol (IP) address.

1   20.   A method of locating an entry in a forwarding database corresponding to a longest

2   match of a search key, the method comprising the steps of:

3   a)   performing a hash function on the search key to produce a current index into

4   a hash table;

5   b)   searching a first bin in the hash table identified by the current index for an

6   entry that matches the search key; and

7   c)   while no entry is found that matches the search key and while the search key

8   is greater than a predetermined length, with each subsequent search iteration

9   performing the steps of

10   1)   shortening the search key to exclude just enough data to cause the

11   hash function to produce a result that is different than the current

12   index;

13   2)   updating the current index with the result of the hash function on the

14   shortened search key; and

15   3)   searching a different bin in the hash table that is identified by the

16   current index.

1   21.   A method of locating an entry in a forwarding database corresponding to a longest

2   match of a search key, the method comprising the steps of:

3   a)   generating indices for a hash table performing a hash function on the search

4   key to produce a current index into a hash table;

5   b)   searching a first bin in the hash table identified by the current index for an

6   entry that matches the search key; and

7   c)   while no entry has been found that matches the search key and while the

8   length of the search key is greater than a predetermined length, with each

9   subsequent search iteration performing the steps of

10   1)   shortening the search key to exclude just enough data to cause the

11   hash function to produce a result that is different than the current

12   index;

13   2)   updating the current index with the result of the hash function on the

14   shortened search key; and

15   3)   searching a different bin in the hash table that is identified by the

16   current index.

1   22.   A networking device comprising:

2   a backplane; and

3   a plurality of input/output (I/O) interfaces coupled to the backplane,

4   each of the plurality of I/O cards comprising

5   a plurality of ports,

6   a forwarding and filtering mechanism coupled to the plurality of ports, the

7   forwarding and filtering mechanism configured to forward data

8   based upon the results of a longest match search of a forwarding

9   database for an entry corresponding to an address contained within

10   the data, where:

11   a mask is applied to the address to determine a masked address to be

12   used for purposes of searching the forwarding database,

13   the forwarding database is searched for entries that match the

14   masked address, and

15   subsequent masks are produced based upon an address-sensitive

16   decimation of the mask.